Hydrology and Earth System Sciences Discussions

Interactive comment on "Regional modeling of vegetation and long term runoff for Mesoamerica" *by* P. Imbach et al.

Anonymous Referee #2

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This paper makes a useful contribution to regional modelling of water balance components such as (evapo)transpiration and runoff, as well as important vegetation parameters such as leaf area index or stomatal conductance based on climate input for Mesoamerica at a resolution of 1km. It is generally clear and well written and the diagrams are clear and relevant. I am convinced of the relevance of this topic and applicability of results to further studies and therefore strongly support the publication of this paper. However, I do have some general questions and more detailed ones further below. In general it would be helpful if the model was described in more detail. Most importantly, I am concerned about the modelling period, which was chosen. Did I understand correctly that longterm monthly averages are simulated? And that a validation is carried out with longterm averages of then different periods? (The language is not very precise here). On the one hand I am curious about the gain of this study,

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if longterm averages are modelled. Shouldn't the aim be to model time series? And if timeseries are indeed modelled, how is this done with the longterm average climate input that is used? And secondly, if longterm averages are constructed from different decades, i.e. modelling period (climate input) and validation period (longterm runoff) do not match, how well does the valdiation work considering decadal climate/runoff variabilities? What is the advantage of using potential vegetation, wouldn't it be more useful to consider actual vegetation, which is available at 1km spatial resolution from remotely sensed data? Especially since on agricultural areas, infiltration and surface runoff behaviour differs from that on potential natural vegetation? Further, irrigation additionally modifies the local water balance. Also urban areas have a very different runoff regime at that resolution due to sealed areas. Shouldn't this be taken into account? Compare P806 L2 "anthropogenic influence has reduced natural vegetation to 58% of the area".

In the following I have more detailed questions that arouse when reading the paper. I tried to indicate page and line number when possible, abbreviated P and L, where ff means including the linies after, F= figure:

P804 L10 – apparently the model is useful if detailed land use maps are missing as it relies on soil data. How good is the soil data in regions where there is no land use data? Maybe this sentence could be re-written?

Which vegetation classes are exactly differentiated – the same as described in Neilson, 1995, i.e. grass and woody vegetation, which can be trees or shrubs, evergreen or deciduous, and needleleaved or broadleaved? Are shrubs part of the tree class? Are the rooting depth assumpions the same in one class (i.e. wood vs. grass)? (see P806 L14)

P804 L11 (iv) evapotranspiration modeled through ecophysiological modelling; in how far is soil evaporation included? Please give equations for these processes.

Is there any lateral transport of water in the model? the Model needs to be explained

in more detail (i.e. include equations)

P805 L11 mean annual surface temperature cannot have small fluctuations over the year, please rewrite sentence

Better distinguish actual and potential evapotranspiration, sometimes it is not clear which one you are talking about.

What exactly is the time step of the model/ which years / period is modelled? Average climate input have different base years? How well do averaging-periods match for runoff and climate? Is a monthly time step suitable for modelling transpiration and soil hydrology if it is based on the modelling of stomatal conductance? Wouldn't a higher resolution in time be necessary? What is the gain to model stomatal conductance in comparison to using a simple rainfall-runoff relationship if average monthly values are desired? P806 L8ff

P806 L10 "interception is a function of the number of rain events and lai" - doesn't the timing of rain events make a difference here, e.g. rain events evenly spread over the months vs. all rain days in a row? Is this considered in the model? What is the effect of this error?

P808 L18 maybe the calibration method section could me moved to follow the sensitivity test section, as it is mentioned there.

P809 L9 Only 135 catchments of 466 are used for calibration and validation? Is any conclusion drawn to the other catchments? Is calibration transferred to catchments without records? If so, how?

P802 L17 / P812 L14 How well can modelled potential vegetation be validated with remotely sensed actual vegetation? And P813 L4 how many pixels had to be excluded because the maps don't concur?

P814 L10ff please specify calibration, validation and modelling periods. How about a map of catchments?

P815 L17 how about using equation 1 from the paper instead?

P819 L20 does this database consist of longterm averages? Is it available for other groups?

F4 – would percentage deviation give a better picture?

F7 – where are these catchments located?

F9 – is this pixel based runoff? It might be helpful to include catchment boundaries?

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